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CONTROLLING PHARMACEUTICAL COSTS: A STUDY TO IDENTIFY PHYSICIAN PRESCRIBING PATTERNS

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In Partial Fulfillment of the

Requirements for the Degree

of

Master of Health Administration

by

Major David R. Heier, MS

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ABSTRACT

The cost of health care in the United States is increasing every year and now consumes more than 12% of the Gross National Product, which roughly equates to $733 billion (Castro, 1991). Numerous studies and initiatives have been undertaken by a variety of private and governmental organizations to control health care expenditures. Several have involved the control of pharmaceutical costs. The purpose of this study was to determine those personal characteristics (variables) associated with physician providers that indicate if a given provider routinely writes outpatient prescriptions which are more costly than those written by his/her peers. A multiple linear regression analysis approach was utilized to determine which, if any, variables are significant. A sample group of 129 physicians, comprising 17 different specialties, was studied. Three operant (dependent) variables were used as measures of high-cost outpatient prescribing behavior. Additionally, 52 predictor (independent) variables were used. The results yielded 11 significant predictors of high-cost prescribing behavior at the .05 level.

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CHAPTER I

INTRODUCTION

Conditions Which Prompted the Study

Every year, the cost of health care in the United States consumes an ever greater portion of the Gross National Product (GNP). Recent estimates from a variety of sources indicate that the rate now exceeds 12% (Zellmer, 1990). Analysts of the health care system estimate that Americans spend $23,000 a second on medical care, which amounts to roughly $2 billion a day. These numbers are even more alarming when considering that the cost of health care has nearly doubled in the last seven years, to include annual increases of 10% in 1990 and 1991. Overall, health care costs have grown 193% since 1980 as compared to a 63% growth rate in the Consumer Price Index during that same period. The Federal Government is especially hard hit by these rising costs, which have proven to be its fastest growing major item cost, averaging 8% annual increases while general inflation is growing at a relatively mild 5% (Castro, 1991).

The cost of pharmaceuticals has played a significant role in the cost of health care in the United States (Jankel, 1990). While drug manufacturers readily market the utility of their many products and the generally positive impact pharmaceuticals have played in the prevention and control of disease, opponents readily cite other issues, to include the high cost of many

prescription drugs, the practice of some providers to overrely on pharmaceuticals as a panacea for illness in spite of other proven and cost-effective therapies, and the fact that pharmaceutical companies reap enormous profits at the expense of ill or injured people while being heavily subsidized by numerous government programs (Pane, 1989).

The cost of pharmaceuticals has gained special interest among businessmen and government officials because, as a single entity in the entire spectrum of the health care industry, prescribed drugs claim the distinction of having the highest rate of inflation. Specifically, while health care costs rose at an annual cumulative rate of about 220% during the period 1980-1990, according to some sources, prescription drugs rose at a rate of 250% ("Why Drug Prices," 1991). Other figures indicate that, during the same period, the general rate of inflation in this country was 58% while the prescription drug inflation rate was 152% (United States Senate, 1991). On average, this was 20% more than overall health care inflation (Green, 1991). To exacerbate the issue even more, economic analysts have indicated that the United States pays more on average for its drugs than other countries. Specifically, the United States pays 62% more than Canada and 54% more than European countries ("Why Drug Prices," 1991). Additionally, Ensor (1992) predicts that the combination of a break with historical spending trends and the advent of

certain new drugs has the potential to cause marked increases in pharmacy expenditures. Furthermore, Nold (1991) contends that cost containment, cost avoidance, and cost reduction are major issues facing the hospital pharmacy.

Some proponents of the current health care system contend that Americans should be spending more on health care and are quick to proclaim that the largely market-based economy is simply responding to the needs of the consumer (Jankel, 1990). A major proponent of this general philosophy for the United States-based pharmaceutical industry is the Pharmaceutical Manufacturers Association (PMA). The PMA is a not-for-profit organization that represents over 100 different pharmaceutical firms. According to its economic analysis of the current health care system, the cost of pharmaceuticals is not a major cause of the current problem with health care costs. Its estimates indicate that prescription drug costs have remained below the overall Consumer Price Index since 1967 and that prices are actually about two-thirds of the overall price index for medical care (see Figure 1) (PMA, 1991).

The PMA (1991) also notes, in defense of the rising cost of drugs, that research and development costs are rising at a much greater rate in the pharmaceutical industry than any other high technology industry (see Figure 2). The PMA's estimates, in conjunction with those of the Bureau of Labor Statistics, indicate that PMA companies expend 16.5% of sales toward research

and development as compared to 10.2% by other industries.

Other data to support the PMA position can be derived from the costs of developing a new drug. The PMA (1991) contends that all costs cannot be recouped from sales of various products and cites a recent study conducted by Duke University which indicates that it requires $231 million to develop a new drug and that only 3 of 10 drugs actually recover their research and development costs (see figures 3 and 4). Additionally, as Figure 5 indicates, PMA member companies claim to have shared a significant public burden regarding biomedical research by outspending the National Institute of Health in 1990.

The PMA (1991) further contends that costs have escalated because product life cycle is significantly shorter than it once was due to foreign competition, which condones patent piracy, and new laws that allow generic drugs to enter the market more quickly. Nevertheless, it still requires 12 years to bring a new drug to the market (see Figure 6). Furthermore, the PMA contends that, although prices have risen, industry profits have been relatively stable since 1982 (see Figure 7).

Other statistics that seem to favor the drug industry in its attempt to deflect blame for rising health care costs, illustrated in Figure 8, indicate that, while total spending for prescription drugs has stayed under 1% of the GNP since 1965, the percent of costs associated with other health care expenditures

in general have doubled (PMA, 1991). Additionally, the PMA (1991) contends that the average American paid only 3% of his/her total wage for health care in 1988 as compared to 3.4% in 1967. Concurrently, drug costs accounted for 5 cents of every health care dollar in 1989 as compared to 7 cents in 1970.

Furthermore, the PMA (1991) illustrates that the difference in drug costs in other countries is primarily due to currency fluctuations and not price gouging by various drug companies (see Figure 9). Perhaps the PMA's strongest argument to continue with current practices is illustrated by Figure 10, which, according to the PMA, demonstrates the overall cost effectiveness of drug therapy as the treatment of choice for many patients because of its overall cost effectiveness.

Overall, the PMA (1991) purports that the numerous assaults on the drug industry as the major culprit in escalating health care costs are based on factual errors, erroneous interpretations, and misstatements. Others in the industry contend that any additional interference by government will cause the pharmaceutical industry to suffer the same fate as the electronics and the automotive industry (Landgraf, 1991).

Critics of the market-based approach to health care argue that the amount of money being spent on health care is too high in relation to the benefits derived. Critics support their claims by pointing to the fact that approximately 37 million

Americans are currently without health care insurance and are therefore denied access to appropriate medical care. Critics also cite the relatively high rates of morbidity and mortality in this society when compared to other industrialized nations (Greenberg, 1988).

A major critic of the pharmaceutical industry has been the United States Senate Special Committee on Aging (1991) and its chairman, Senator David Pryor. According to subcommittee findings, which all refute the claims of the PMA, the drug industry has a significant influence on the rising cost of health care and pharmaceuticals. Specifically, Pryor and his colleagues cite the pharmaceutical industry as the single highest inflating component of the entire medical inflation index. Citing enormous profit margins fueled by an 11.3% drug inflation rate in 1991 (see Figure 11), Senator Pryor has introduced legislation to curb what he claims to be abuses by the industry. Pryor and his associates claim that, in 1990, the drug industry enjoyed profits of 15.5% while the overall average of all other Fortune 500 companies was 4.6% (see Figure 12). Countering other drug industry claims, Pryor and his associates state that, in 1991, the drug industry expected to spend $9 billion on research and development but $10 billion on marketing, much of which was to be effected through "educational symposia" conducted at plush resorts for the benefit of physicians and their spouses. All of

this is intensified by the fact that the drug industry is heavily subsidized by federal tax credits that have not only increased profits but have also given the industry an incentive to move plants to Puerto Rico, depriving mainland citizens of jobs.

Research by the United States Senate Special Committee on Aging (1991) indicates that drug inflation rose at an annual rate of 18.5% more than general inflation each year during the 1980s (see Figure 13). This resulted in an overall prescription drug inflation rate of 158% compared to a general overall inflation rate of 58%.

The soaring costs of pharmaceuticals have not been avoided by the Department of Defense and, specifically, the Army Medical Department and Health Services Command (HSC). Recent figures indicate a dramatic increase in costs. For example, in 1986, HSC spent approximately $106 million on prescription drugs. This figure escalated dramatically to $185 million in 1991 (see Figure 14), despite the absence of any significant rise in workload (Gill, 1992). Whereas cost increases are usually tied to similar increases in workload, now pharmacy costs appear to be rising geometrically. Current estimates also indicate that the typical HSC hospital spends about 40%-50% of its consumable supply dollars on prescription drugs (Cahill, 1992). These trends are expected to continue and, if they continue unabated, will have significant negative consequences for HSC's ability to provide

appropriate medical care to its beneficiary population in a managed care environment.

Statement of the Problem

Because pharmacy costs are rising at an alarming rate and are having a negative impact on its ability to deliver quality health care, HSC is undertaking an extensive study to determine how to control pharmacy costs (Gill, 1992). As an adjunct to this command initiative, this graduate management project focused specifically on physician characteristics as outlined on the Officer Record Brief in an attempt to determine if there are any significant characteristics (variables) associated with physicians that may enhance early identification of high-cost providers and in turn allow appropriate intervention.

Review of the Literature

The costs of pharmaceuticals and the effectiveness of their use have been subjects widely studied for quite some time. However, most research regarding the pharmaceutical industry in general and physician prescribing practices in particular has been conducted on a small scale. As a result, today one sees cost-control initiatives from all facets of society. The United States Senate Special Committee on Aging (1991), for example, completed an indepth study of the pharmaceutical industry in 1991. The general conclusion of this committee is that drug costs are out of control and that pharmaceutical companies are

unfairly subsidized by the same taxpayers from whom they profit.

Even before the dramatic increases in health care spending witnessed in recent years (see Figure 15), researchers and practitioners alike often explored the effectiveness of various drugs to determine their optimal use and, in turn, their most efficient and, hopefully, most cost-effective use. Jankel (1990) reports that 1966 witnessed the first use of cost-benefit analysis techniques by practitioners in an effort to determine the most cost-effective drug to use. This practice, in turn, helped pave the way for recent and current cost-control initiatives.

Dannenhofer, Slaughter, and Hunt (1989) explored the use of monitoring and a preprinted note in an administrative technique to modify prescribing practices of physicians for cimetidine and ranitidine. Lyon (1990) focused on more popular and more traditional approaches to pharmacy cost control by exploring pharmacy management practices and formulary control procedures.

Kawahara and Jordan's (1989) study attempted to control costs by focusing on appropriate drug utilization, while Evans (1989) focused his efforts on studying provider education programs. Linn and Davis (1972) questioned a random sample of 131 general practitioners in an effort to gain insight into prescribing behavior and associated physician attitudes. Another study, by Becker, Stolley, Lasagna, McEvilla, and Sloane (1972),

used interviewing techniques to determine prescribing habits of 31 physicians regarding five common illnesses.

Mapes (1977a) examined 54 British general practitioners and concluded that "physicians who were incautious prescribers were significantly more likely to value the pharmaceutical industry as a source of pharmaceutical knowledge" (p. 377). Research by Haayer (1982) using a questionnaire administered to 116 physicians in the Netherlands found similar results.

Hemminki (1974) used the questionnaire technique also to gather demographic information on the prescribing practices of 47 physicians to determine reliance on specific source information as it relates to prescribing practices. Her research found no significant difference in the frequency of prescribing behavior as related to source of information. Other studies concentrating on demographics as a determinant of prescribing practices included those of Linn (1971), Mapes (1977a), and Parish (1974). All three concluded that age was a factor in physician prescribing practices, stating that younger physicians prescribed more. A similar study by Hadsall, Freeman, and Norwood (1982) found age not to be a determinant in the frequency of prescribing. The study by Hemminki (1974) also showed that sex did not affect prescribing practices.

Linn (1971) found that quantity of postgraduate educational courses did not affect prescribing practices. Similarly, Hadsall

et al. (1982) found that board certification was not significantly related to the prescribing of certain drugs. However, Joyce, Last, and Weatherall (1967), who studied prescribing differences in three different English towns, did find that physicians who reported a greater degree of satisfactory education were more likely to write fewer prescriptions.

Mendel's (1967) study showed that inexperienced physicians wrote more prescriptions than those with more training. Becker et al. (1972), in their study, verified Mendel's results regarding the amount of formal training and the appropriateness of prescribing.

Research by Blum, Banks, Barker, Blum, Crawford, Garfield, Garfield, and Garvin (1972), who studied physicians employed in a health maintenance organization, and by Mapes (1977a) found that physicians who routinely were classified as heavy prescribers were also less rational prescribers in that they used prescriptions as a quick way to handle large patient loads. Also, Hadsall et al. (1982) found that physicians who did not feel that their patients expected drug therapy as an outcome of a physician visit had low prescribing rates. Fleming and Cross (1984) verified the finding of Maronde, Lee, McCarron, and Seibert (1971) that physicians who routinely wrote many prescriptions for one type of drug also had a tendency to write

many prescriptions for other types.

Becker et al.'s (1972) study indicated that physicians in group practice were more appropriate prescribers than those in solo practice. A study in Montreal, Canada, on the other hand, indicated that salaried physicians in government-funded community health centers were better prescribers in terms of appropriateness of drug than their peers in fee-for-service group practice (Renaud, Beauchemin, Lalonde, Poirier, & Berthiaume, 1980).

A four-year study of a clinical pharmacy intervention program showed that significant cost savings can be realized through the use of a clinical coordinator (Catania, Yee, & Catania, 1990). Similar conclusions regarding cost reductions in the pharmacy are reported by Haig and Kiser (1991) from their study, which focused on a multidisciplinary approach involving a hospital-based pharmacist and which controlled costs and charges and reduced lengths of stay.

Similar initiatives have been undertaken by HSC activities, especially in terms of pharmacy management and volume purchasing. One study, by Walker (1987), explored the difference in costs between over-the-counter medications dispensed by HSC pharmacies and those available from commercial pharmacies.

The relationship between prescribed medication and physicians is aptly summarized by Lexchin (1986) when he states:

> Physicians possess the key to open the cabinet from which prescription drugs are dispensed. The key is in the prescription that first must be ordered by the physician before any further events ensue. It is important to understand when and how physicians engage in the practice of prescribing drugs and how such patterns become established. (p. 71).

Purpose of the Study

The purpose of this study was to determine those military physician characteristics (variables) that are associated with high-cost outpatient prescribing behavior. This purpose was based on the hypothesis that certain personal characteristics differentiate those physicians that are high-cost prescribers from those who are not high-cost prescribers.

CHAPTER II

METHOD AND PROCEDURES

Subjects

Data were collected on 129 military physicians located at three separate Army hospitals, specifically, Fort Hood, Fort Riley, and Fort McClellan. Each physician was a licensed practitioner working in a prescribed specialty. No residents or interns were included in the study.

The sample was selected by obtaining names of military physicians from each medical treatment facility that was known to be tracking physician prescribing cost data during the period October 10, 1991, to March 30, 1992. After obtaining the appropriate cost data for each physician from the appropriate source within each activity (Research Management Division, Pharmacy, or Clinical Support Division), each physician's Officer Record Brief (ORB) was obtained from the U.S. Army Health Services Command Office of the Deputy Chief of Staff for Personnel. Once obtained, data from the ORB, which contains personal and professional data for each officer, were recorded for use in the study.

Study Design and Procedure

The study consisted of 55 separate dichotomous and continuous variables (see Appendix). The variables were analyzed using a multiple linear regression analysis technique utilizing Microstat

software. This technique was employed to ensure that each variable would be accurately measured and that the effects of each independent variable would be adequately controlled as each separate variable was compared to each dependent variable. This method is consistent with that of other research, specifically, that conducted by Allgood and Heier (1991).

In this nonexperimental retrospective study, validity was measured by a computer-generated correlation matrix, again, utilizing Microstat software. Results indicate that overall the measurement was valid, as 13 of the 52 predictor variables consistently exceeded the critical value of the .05 level for at least one of the three dependent variables. Additionally, one variable, Internal Medicine, demonstrated significance with all three dependent variables. The independent variables labeled Family Practice and Orthopedics demonstrated significance with two dependent variables while the remaining eight independent variables demonstrated significance at the .05 level with one dependent variable.

From these findings, one can conclude that there was a degree of criterion-related validity in the study. One can also conclude that the instrument has a certain degree of content validity due to the wide variety of variables utilized to determine those characteristics which could be considered as predictors of high-cost prescribing behavior. Reliability was an elusive concept in

this study because this research was not an exact replication of any previous research although the techniques utilized were similar to those employed in the study by Allgood and Heier (1991).

The accuracy of the data kept in the various activities that compiled the pharmacy cost data and of the data recorded on the Officer Record Briefs must be assumed to be reliable. This study was retrospective in nature and attempted to address ethical considerations by utilizing secondary data and safeguarding physicians' identity.

A multilinear regression analysis, a correlation matrix, and a full model regression analysis were used to test 52 separate independent variables against three dependent variables relating to total number of prescriptions, total cost, and average cost. Table 1 depicts the descriptive statistics which were calculated to provide a meaningful and complete picture of the data. Table 2 lists the means and the standard deviations for the three dependent variables. Table 3 presents the correlation values for all 17 variables classified as specialties and the one nonspecialty variable (board certified) that demonstrated significance at the .05 level. Additionally, rank (captain and major) showed significant correlation. Table 4 presents the data for the three independent variables by location. Table 5 depicts the results of the analysis of variance related to each dependent

variable when only the three independent variables related to site were subjected to multiple linear regression analysis. Finally, Table 6 presents the overall predicted values for the 17 different specialties analyzed in this study.

CHAPTER III

RESULTS

The results of this study indicate significant intercorrelations among the dependent variables, which would suggest a high degree of relationship between those concepts defined as repre-senting high-cost prescribing behavior. The results also indicate that the vast majority of variables utilized, especially those relating to demographics, are not signficant predictors at the .05 level. Only one of the 52 independent variables (Internal Medicine) demonstrated significance for all three dependent variables at the .05 level.

Full model multiple linear regression yielded R squared values of .9789 for number of prescriptions, .9438 for total cost, and .7337 for average cost. Restricted model multiple linear regression yielded R squared values of .8999, .9065, and .5573, respectively.

CHAPTER IV

DISCUSSION

The results of this research support the alternate hypothesis that various independent variables can be used to predict which physicians will be high-cost providers in terms of the number of prescriptions dispensed, the total cost of the prescriptions, and the average cost of the prescriptions. The results did not exhibit any significant correlation for demographic data such as race, age, sex, and religion or for criteria specifically related to the military, such as awards, assignments, military schooling, or source and type of commission.

The correlation matrix shows numerous inverse (although nonsignificant) relationships between many of the predictor variables and the dependent variables. For example, majors and colonels have a tendency to write fewer prescriptions than captains and lieutenant colonels. Likewise, older physicians with more active federal service who are Uniformed Services University of the Health Sciences and Officer Advanced Course graduates have a tendency to write fewer prescriptions. As expected, these same variables showed similar negative correlations, although not significantly, regarding the dependent variable labeled Total Cost. Similar negative correlations were found with physicians who had more awards and skill badges and

with those who had more dependents. A slight negative correlation between height and total prescriptions written was also noted. Although officers with more active federal service showed slight negative correlations regarding the number of prescriptions they wrote and the total cost of those prescriptions, average cost per prescription tended to be higher, but not significantly higher. Because the results demonstrated significant correlation primarily with given specialties, one could conclude that these findings tend to verify those of Bush (1983), who claims that physicians are primarily conditioned to prescribe in accordance with their training environment.

The results presented in Table 5 demonstrate that significant differences exist ($p < .001$) between the three medical treatment facilities in terms of the average number of prescriptions written per physician and the average total cost of prescriptions written at the three facilities. The average cost of prescriptions written showed no significant difference. One would expect differences between the facilities based on the size of the population served, the location of the facilities, and the number of physicians practicing at each location. The fact that average cost shows no signficant difference is entirely plausible because many medications are purchased through the federal supply system, which sets standard nationwide prices.

The results outlined in Table 6, derived from the

calculation of residuals from multilinear regression analysis, show the average number of prescriptions, the average total monthly cost, and the average cost per prescription for each of 17 specialties. This information is valuable because it can be used as a model to predict costs in any of the 17 specialties included in this study. For example, the data show that a typical pediatrician would prescribe 291 medications per month, for which the total cost would be $1,748.68 per month and the average cost would be $9 per prescription.

Overall, the results of this study tend to confirm what many have believed for some time, i.e., certain specialists tend to be higher-cost prescribers. This study clearly verifies this belief but, more importantly, has eliminated other possible causes of high-cost prescribing. One would naturally think that age (years of experience), schooling, and active federal service (time with the organization) would have a significant impact on prescribing behavior. This study has demonstrated that this is not the case.

The distinctively significant results associated with rank are quite interesting. Although rank was not a significant predictor of the number of prescriptions a physician would write or the total cost of those prescriptions, two ranks--captain and major--were significant regarding average cost. Captains write prescriptions with a low average cost (correlation: -.2345) whereas majors write prescriptions with a statistically

significant high average cost (correlation: .2209). One can only speculate as to why this difference exists. Perhaps this finding verifies the work of Bush (1983), who claims that gradually the primary influence on the use of drugs shifts away from what a physician learned in medical school and toward what the physician's senior colleagues do.

There are a few possible weaknesses in this study which, in turn, could serve as an appropriate springboard for further research. The first weakness is the sample size. Although 129 is a sizable number of physicians to study and this number surpasses that of most studies in this area of research, a more representative analysis could be derived if the sample size were closer to 200. This would also allow inclusion of more physicians in the lower density specialties, especially the surgical subspecialities such as urology and neurosurgery.

Another possible weakness lies in the fact that only six months of cost data could be obtained. A full year of cost data would allow for consideration of seasonal fluctuations in disease and illness. The fact that data for only autumn and winter months were analyzed could have skewed some data, especially for some of the lower density specialties. As the tracking of physician cost data related to outpatient pharmaceuticals spreads, as it has to at least two additional Medical Department activities since this study began, more reliable data over a

longer period of time will be available for further research. This further research could remedy both the small sample size and the possible seasonal fluctuations in prescribing practices.

CHAPTER V

CONCLUSION AND RECOMMENDATION

The need to study physician prescribing practices is more important today than ever. With numerous new, often better, but almost always more costly, drugs coming to market each year, the appropriate use of these drugs will continue to have a significant impact on health care organizations of all types and their ability to offer cost-effective and high quality patient care. This study has demonstrated that there are significant personal characteristics associated with physicians that affect their prescribing practices. As such, this study complements research accomplished by many others.

The value of this study lies in the methodology utilized and its reliance on objective data as opposed to the results of questionnaires and interviews, utilized by many researchers. Further research using the method outlined herein could, hopefully, present an even clearer picture of why physicians prescribe the way they do and, in turn, promote meaningful strategies to deal with the high cost of health care as specifically related to pharmaceuticals.

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Table 1

Descriptive Statistics: Demographics of Physicians

Variable	N	Percent	Average	S.D.
Rank:				
Captain	48	37.21	--	--
Major	62	48.06	--	--
Lieutenant Colonel	11	8.53	--	--
Colonel	8	6.20	--	--
Total	**129**	**100.00**	--	--
Age in years	--	--	37.03	7.15
Active federal service in months	--	--	99.93	54.49
Advanced Course graduate	35	27.13	--	--
USUHS graduate	7	5.43	--	--
Foreign graduate	8	6.20	--	--
Military residency	94	73.44	--	--
Board certified	58	45.74	--	--
Regular Army	18	13.95	--	--
Direct appointment	82	63.57	--	--
Born in United States	106	82.95	--	--
Male	110	84.50	--	--
Ethnicity:				
White	107	82.95	--	--
Black	12	8.53	--	--
Hispanic	7	5.43	--	--
Other	4	3.16	--	--
Total	**129**	**100.00**	--	--
Number of dependents	--	--	2.50	1.50
Religion:				
Roman Catholic	47	36.43	--	--
Protestant	63	48.84	--	--
Jewish	3	2.33	--	--
Other	16	12.40	--	--
Total	**129**	**100.00**	--	--
Married	107	83.00	--	--
Number of military schools	--	--	2.50	1.50
PULHES all 1s	103	80.00	--	--
Height in inches	--	--	69.71	3.30
Weight in pounds	--	--	167.45	26.80
Number of awards	--	--	5.20	3.20
Number of badges	--	--	0.36	0.72
Number of assignments	--	--	3.10	1.70

Table 2

Means and Standard Deviations for Dependent Variables

	$\bar{X}$	S.D.
Number of prescriptions	209.55	257.20
Total cost	$1,941.12	$2,849.75
Average cost per prescription	$ 9.56	$ 5.01

Table 3

Results by Department/Service

Department	N	Percent	Number of Prescriptions (6 months) r	Total Cost (6 months) r	Cost per Prescription (6 months) r
Obstetrics/gynecology	14	11	.14	.14	.07
Family practice	9	7	.33*	.18*	.06
Dermatology	3	2	.09	.02	.02
Internal medicine	18	14	.34*	.55*	.33*
General surgery	13	10	.18*	-.16	-.08
Pediatrics	17	13	.12	.03	-.17
Psychiatry	4	3	-.13	-.10	.23
Neurosurgery	2	2	.02	.08	.16
Orthopedics	10	8	-.18*	-.14	.20*
Ophthalmology	1	1	.02	-.01	-.06
Physical medicine	2	2	-.04	-.06	-.01
General medicine	12	9	-.01	-.02	-.19*
Emergency medicine	18	14	-.10	-.11	-.18*
Otolaryngology	2	2	.05	-.04	.00
Anesthesia	1	1	-.07	-.06	-.08
Urology	2	2	-.05	-.01	.16
Pathology	2	2	.08	-.07	.03
Total	129	100	--	--	--
Board certified	--	--	.07	.06	.21
Captain	--	--	.08	.05	-.23
Major	--	--	-.10	-.04	.22

*Significantly different from other specialties, $P < .05$.

Table 4

Predicted Values Related to Site

Site	Average Number of Prescriptions	Average Total Cost	Average Cost
Fort Riley	376.80	$3,357.44	$9.95
Fort McClellan	342.01	3,456.76	9.23
Fort Hood	123.99	1,135.83	9.50

Table 5

Analysis of Variance

Sum of Squares	df	Mean Square	F ratio	P
		Number of Prescriptions		
1717183.0604	2	858591.5302	16.026	
6750276.6194	126	53573.6240		
8467459.6798	128			P <.001
		Total Cost		
151049881.1815	2	75524940.5908	10.711	
888445053.0709	126	7051151.2148		<.001
1039494934.2528	128			
		Average Cost		
6.6886	2	3.3443	.131	.8772
3211.7936	126	25.4904		
3218.4823	128			

Table 6

Overall Predicted Values

Specialty	Number of Prescriptions	Average Total Cost	Cost per Prescription
Obstetrics/gynecology	80.58	$ 562.25	$ 8.52
Family practice	520.56	3,790.60	8.54
Pediatrics	290.77	1,748.68	7.34
Dermatology	358.00	2,321.48	9.00
Internal medicine	418.02	5,797.75	13.77
General surgery	69.38	621.20	8.43
Psychiatry	21.58	369.45	16.08
Neurosurgery	254.98	3,706.83	16.00
Orthopedics	50.99	538.72	13.01
Ophthalmology	262.33	1,661.17	6.33
Physical medicine	136.75	653.19	9.26
General medicine	177.25	1,290.29	6.18
Pathology	38.16	404.66	10.86
Emergency medicine	143.16	1,156.34	7.39
Otolaryngology	105.16	997.41	9.51
Anesthesia	12.83	66.55	5.19
Urology	105.41	1,716.92	15.82

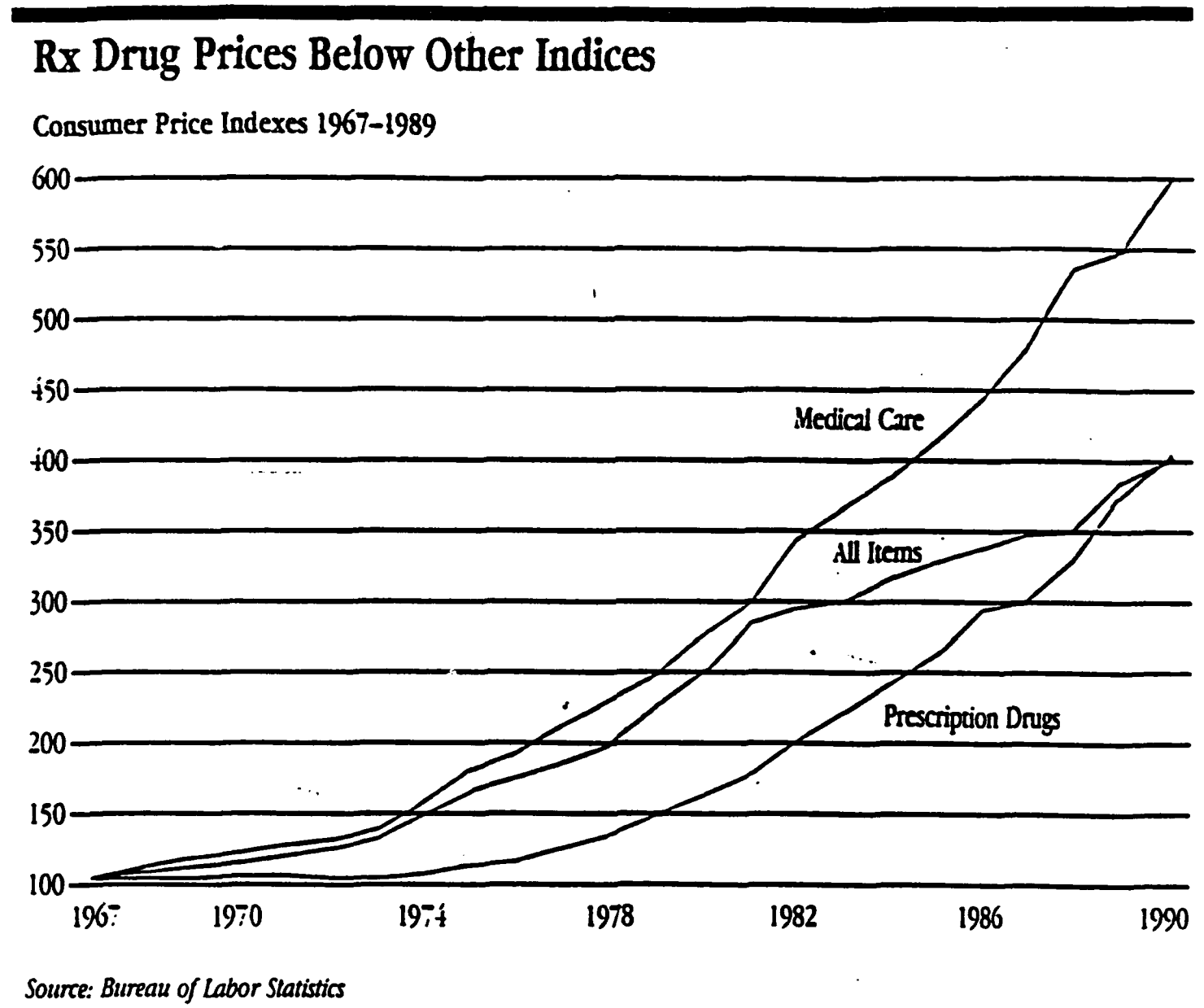
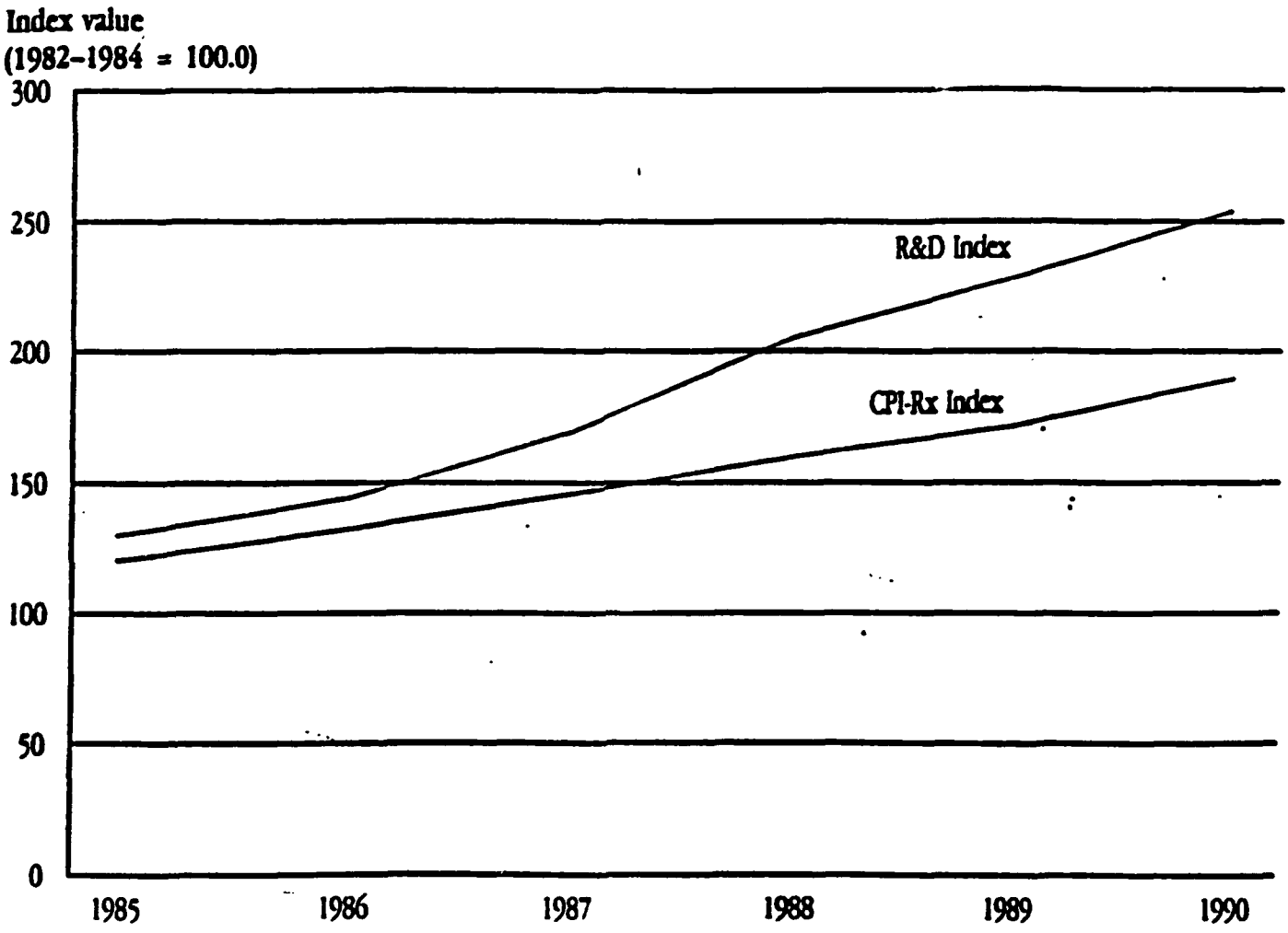


Figure 1. Increases in research and development versus increases in drug prices.
Note. From Industry Perspective: Drug Prices (p. 1) by Pharmaceutical Manufacturers Association, 1991, Handout.

Increases in R&D Spending vs. Increases in Drug Prices



Source: Bureau of Labor Statistics and PMA Annual Survey

Figure 2. Increases in research and development spending versus increases in drug prices.
Note. From Industry Perspective: Drug Prices (p. 1) by Pharmaceutical Manufacturers Association, 1991, Handout.

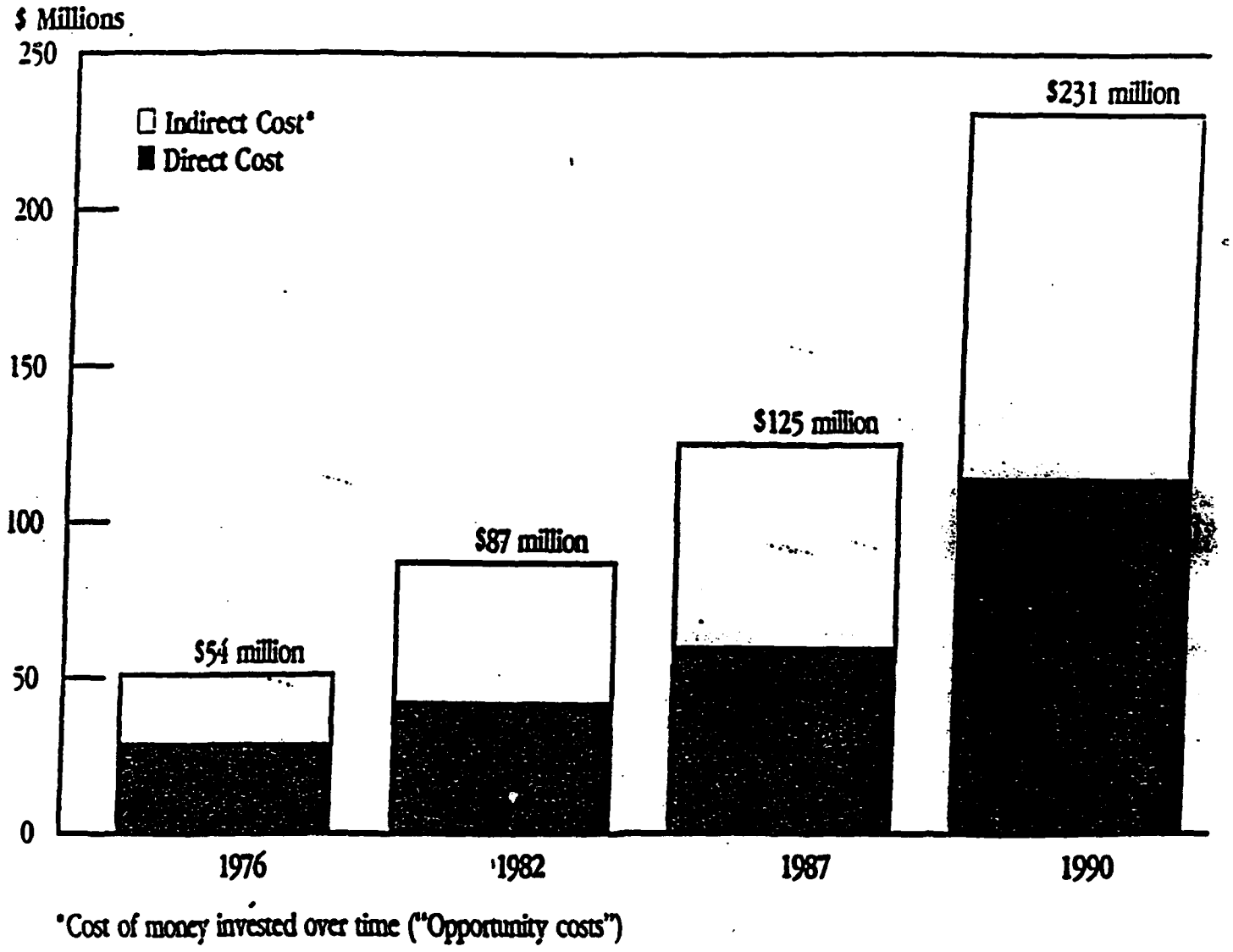


Figure 3. Cost of developing a new drug.
Note. From Industry Perspective: Drug Prices (p. 2) by Pharmaceutical Manufacturers Association, 1991, Handout.

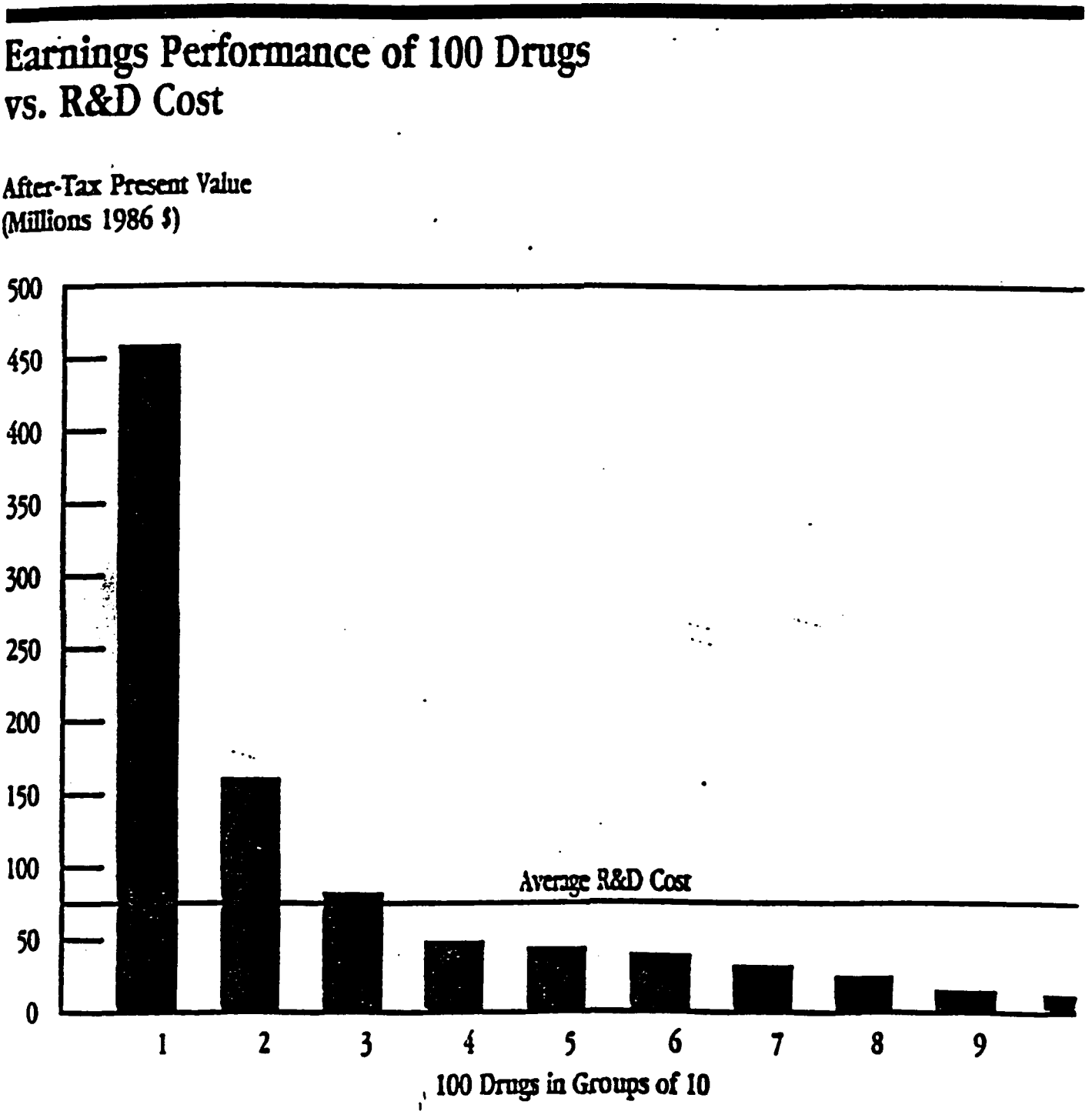
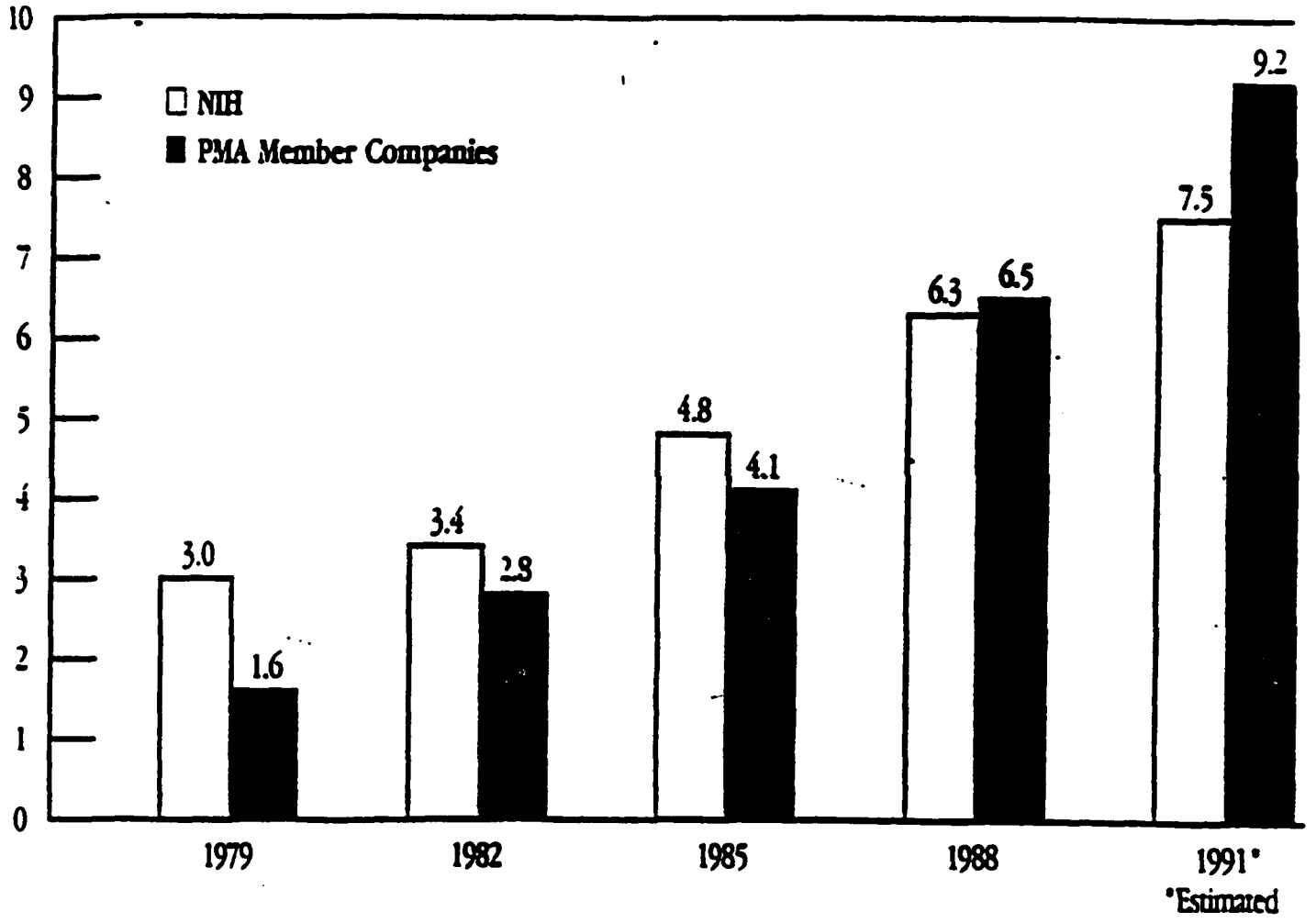


Figure 4. Earnings performance of 100 drugs versus research and development cost.
Note. From Industry Perspective: Drug Prices (p. 2) by Pharmaceutical Manufacturers Association, 1991, Handout.

R&D Expenditures by NIH and PMA Members 1979–1991



Source: National Institutes of Health and PMA Annual Survey

Figure 5. Research and development expenditures by National Institutes of Health and Pharmaceutical Manufacturers Association members, 1979-1991. Note. From Industry Perspective: Drug Prices (p. 2) by Pharmaceutical Manufacturers Association, 1991, Handout.

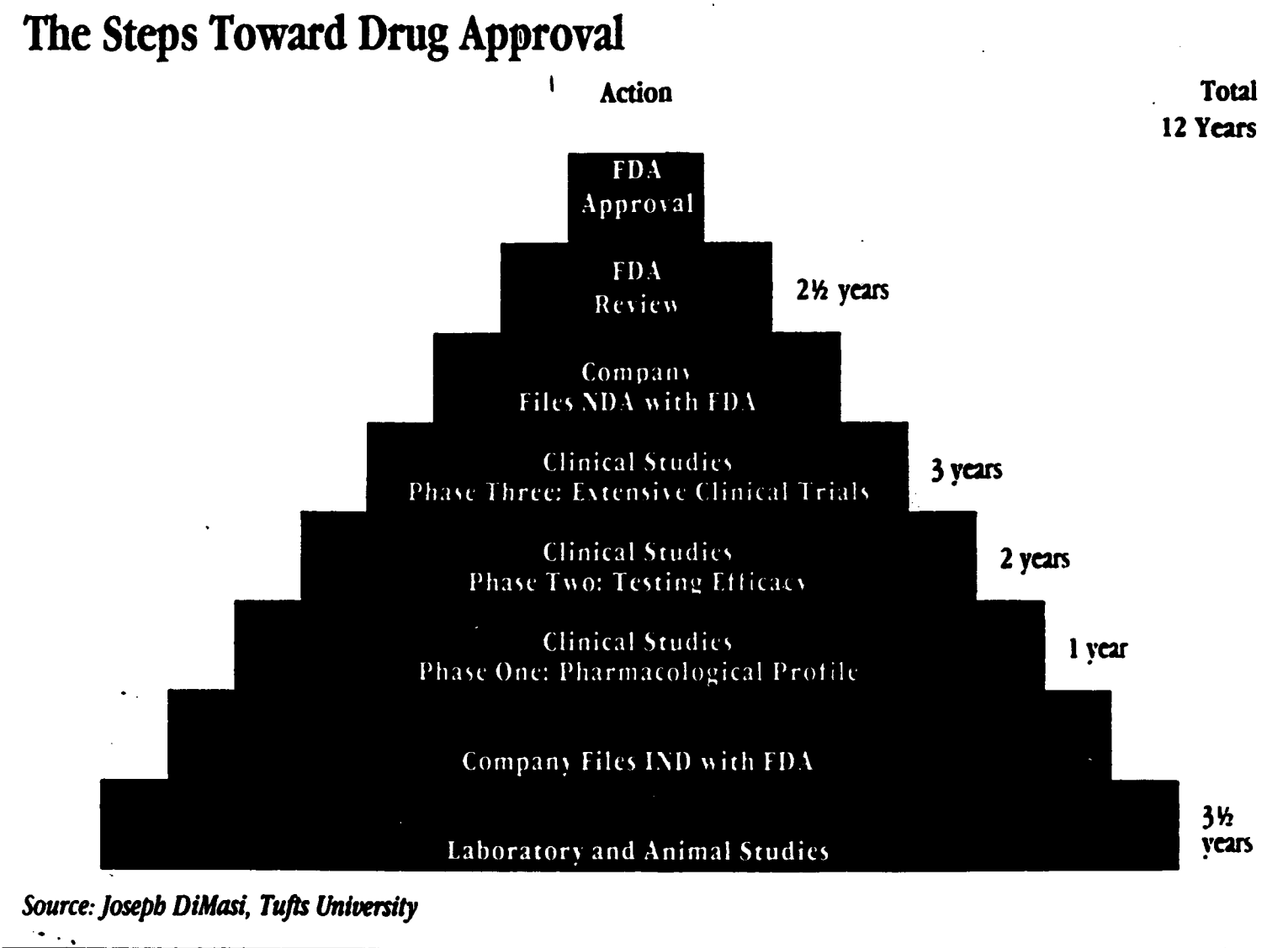


Figure 6. The steps toward drug approval.
Note. From Industry Perspective: Drug Prices (p. 3) by Pharmaceutical Manufacturers Association, 1991, Handout.

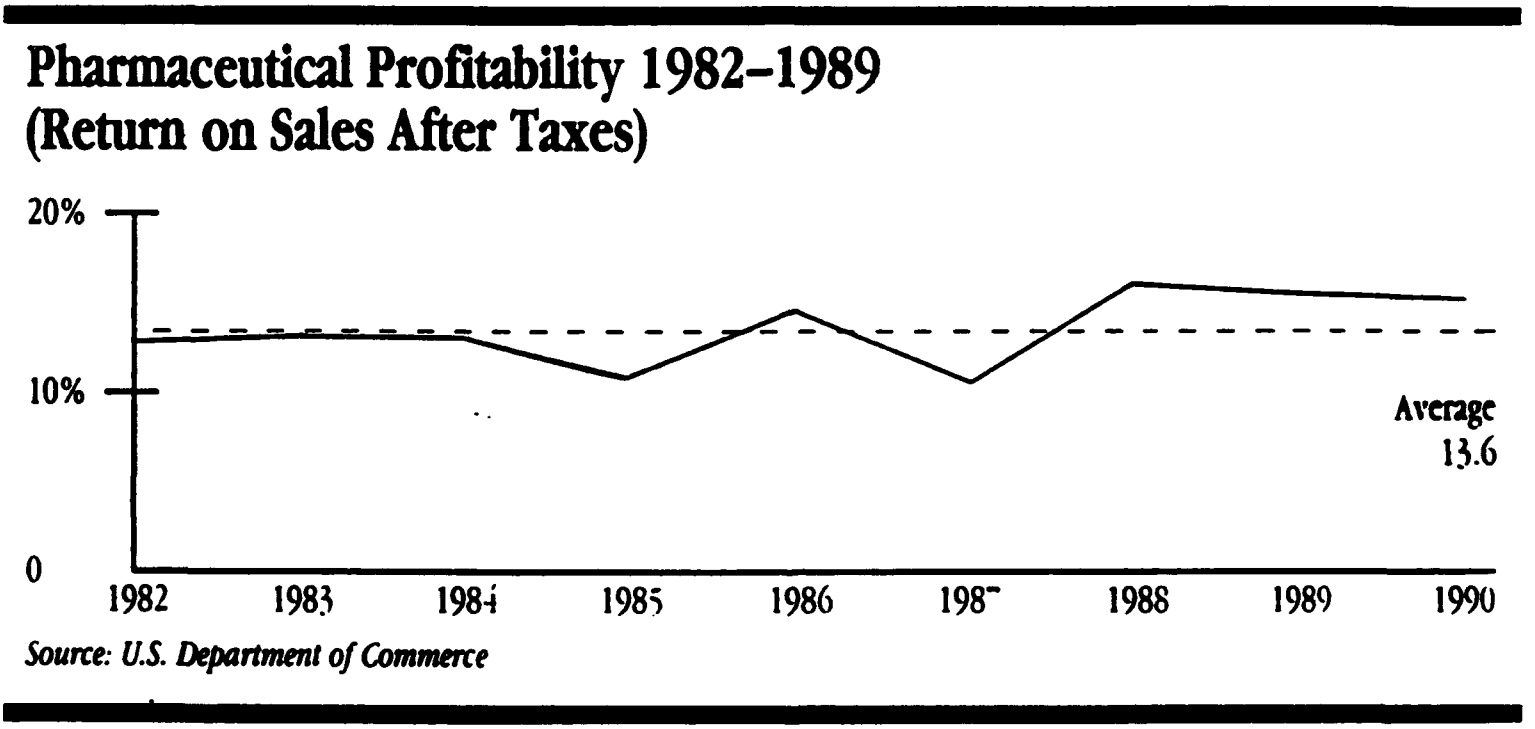


Figure 7. Pharmaceutical profitability, 1982-1989 (Return of sales after taxes).
Note. From Industry Perspective: Drug Prices (p. 3) by Pharmaceutical Manufacturers Association, 1991, Handout.

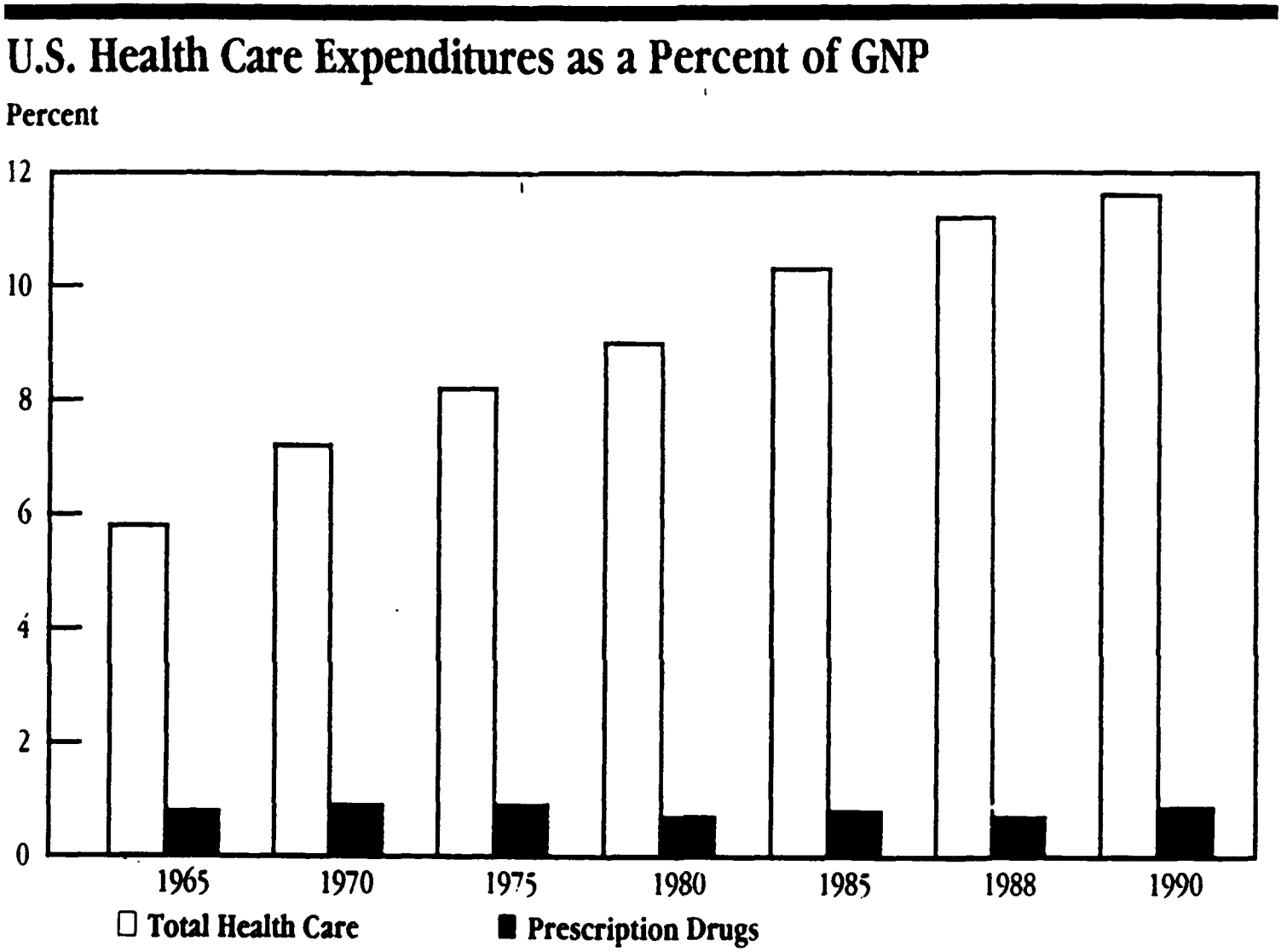


Figure 8. United States health care expenditures as a percent of Gross National Product.
Note. From Industry Perspective: Drug Prices (p. 3) by Pharmaceutical Manufacturers Association, 1991, Handout.

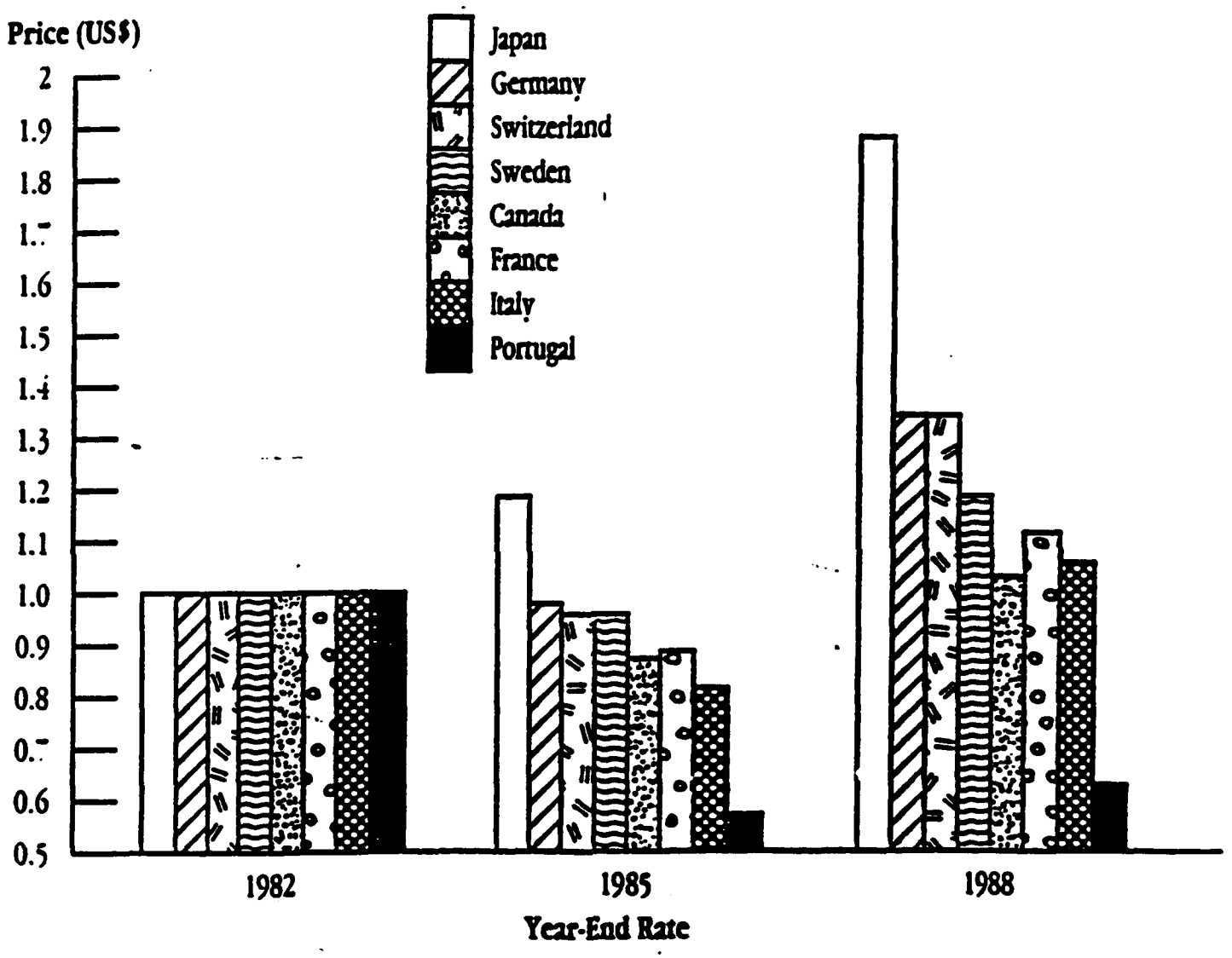


Figure 9. Exchange rate effect of product introduced in 1982 at equivalent of $1.
Note. From Industry Perspective: Drug Prices (p. 4) by Pharmaceutical Manufacturers Association, 1991, Handout.

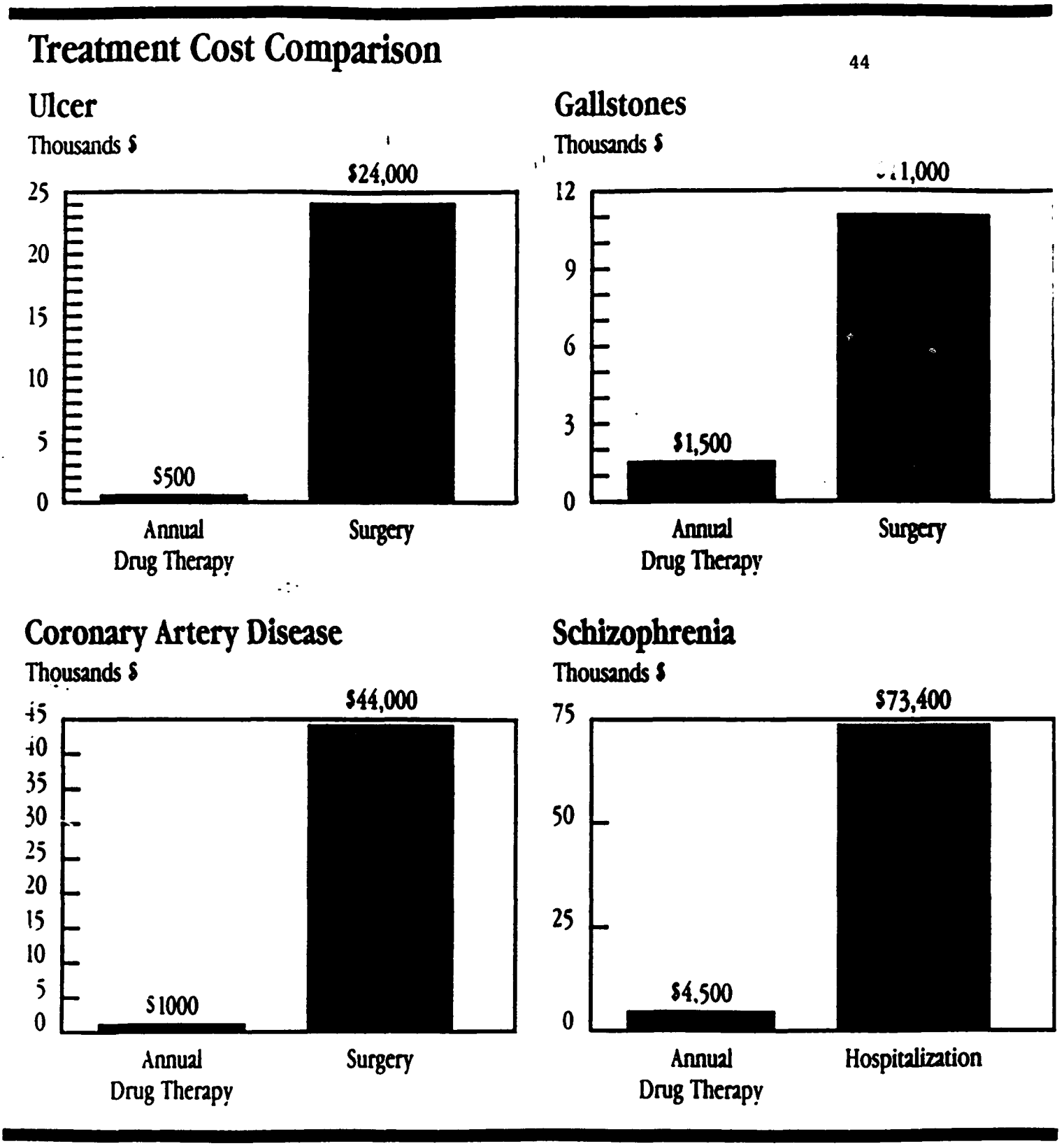
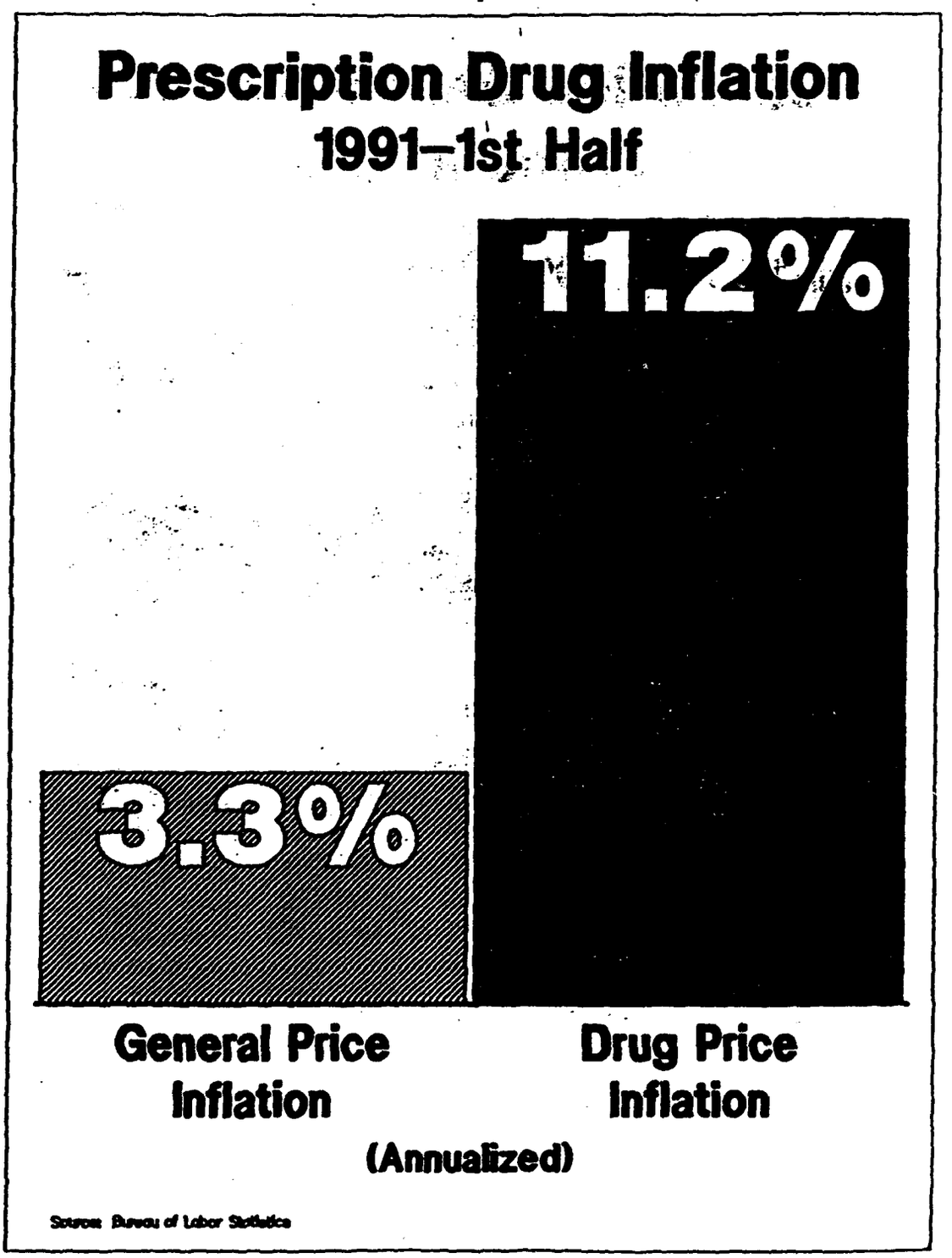


Figure 10. Treatment cost comparison.
Note. From Industry Perspective: Drug Prices (p. 4) by Pharmaceutical Manufacturers Association, 1991, Handout.

Figure 11. Prescription drug inflation, 1991, first half.



Note. From The Drug Manufacturing Industry: A Prescription for Profits (Staff Report, Serial No. 102-F) (p. 22) by United States Senate Special Committee on Aging, 1991, Washington, DC: Government Printing Office.

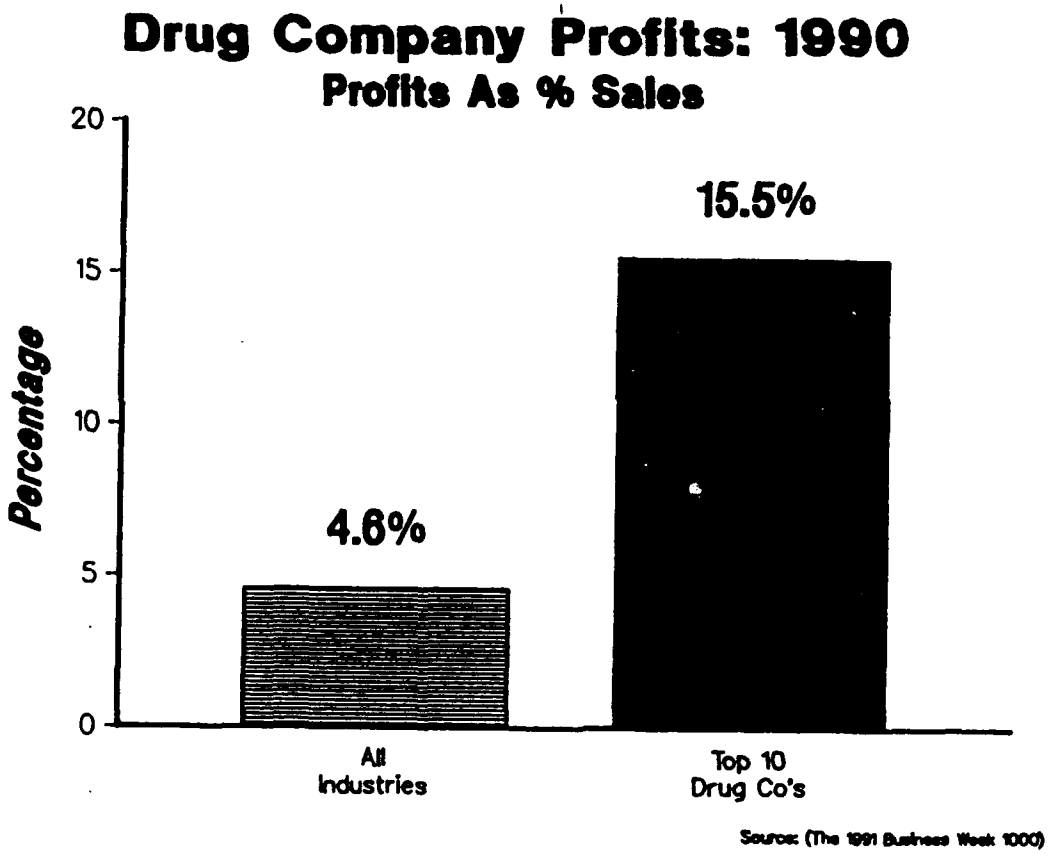


Figure 12. Drug company profits, 1990.
Note. From The Drug Manufacturing Industry: A Prescription for Profits (Staff Report, Serial No. 102-F) (p. 24) by United States Senate Special Committee on Aging, 1991, Washington, DC: Government Printing Office.

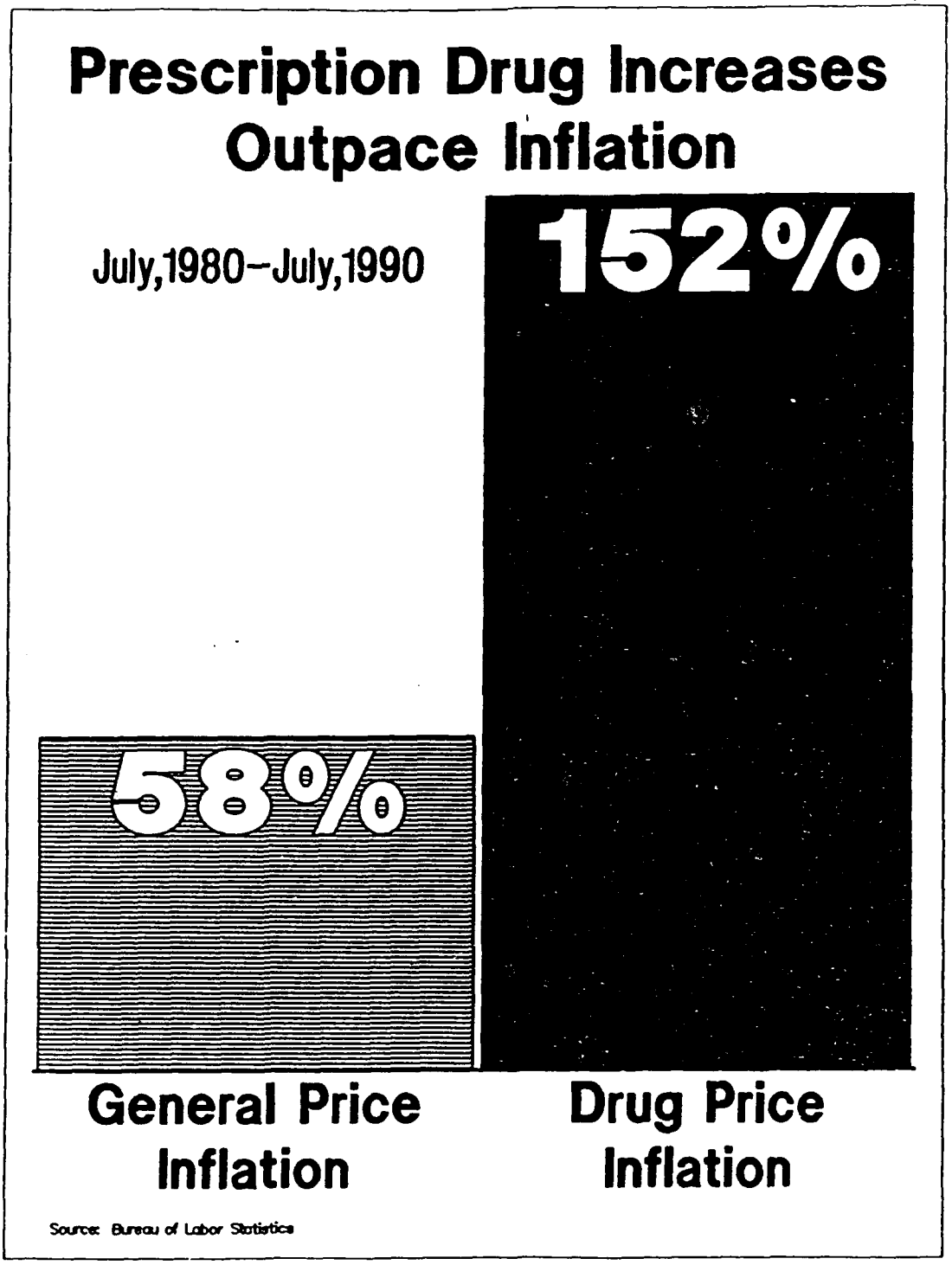


Figure 13. Prescription drug increases outpace inflation, July 1980-July 1990.

Note. From The Drug Manufacturing Industry: A Prescription for Profits (Staff Report, Serial No. 102-F) (p. 21) by United States Senate Special Committee on Aging, 1991, Washington, DC: Government Printing Office.

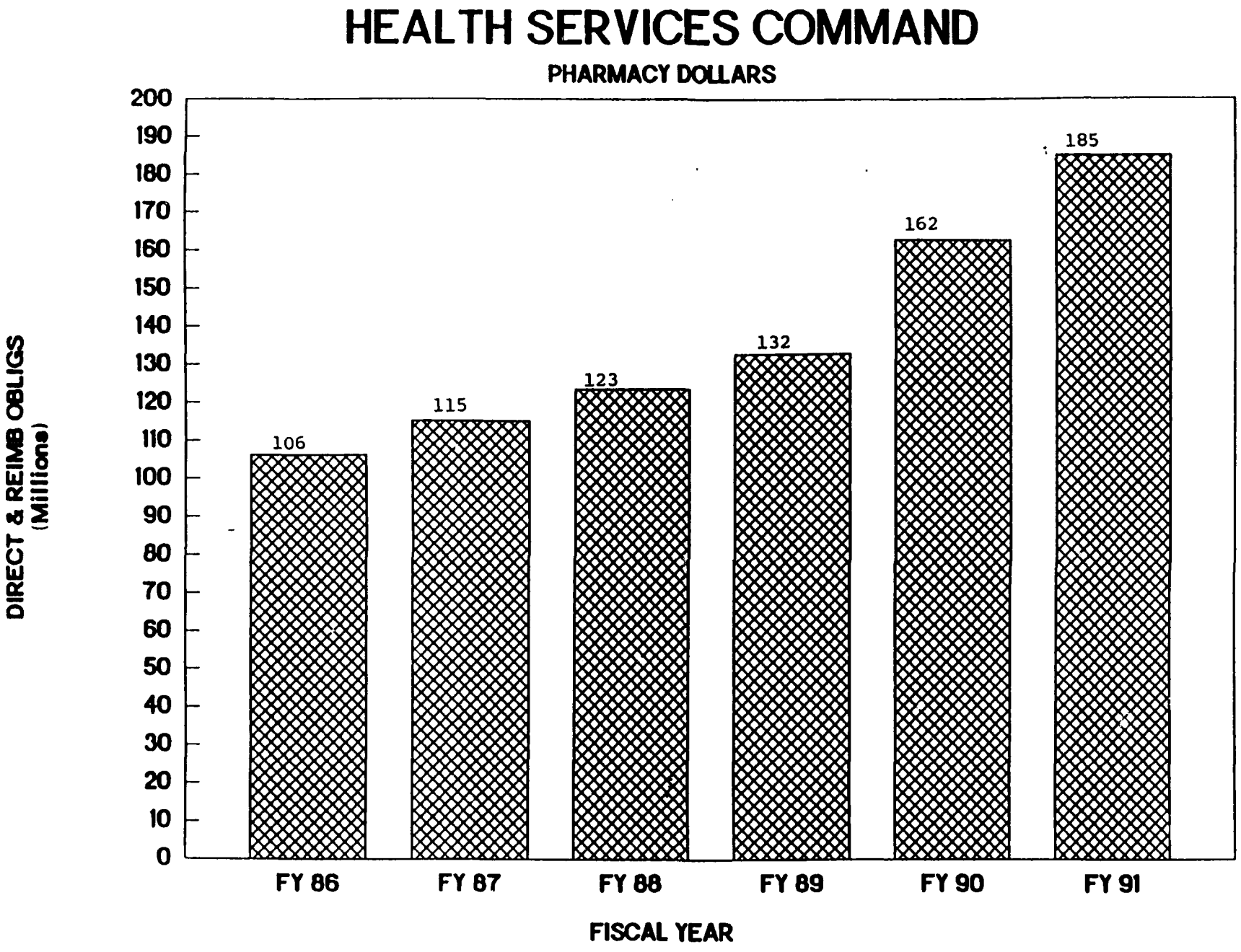


Figure 14. Health Services Command pharmacy expenditures, fiscal years 1986-1991.
Note. From Enclosure to HSC pharmacy estimated unfinanced requirement at midyear review, FY 92 by A. W. Gill, 1992, U.S. Army Health Services Command memorandum.

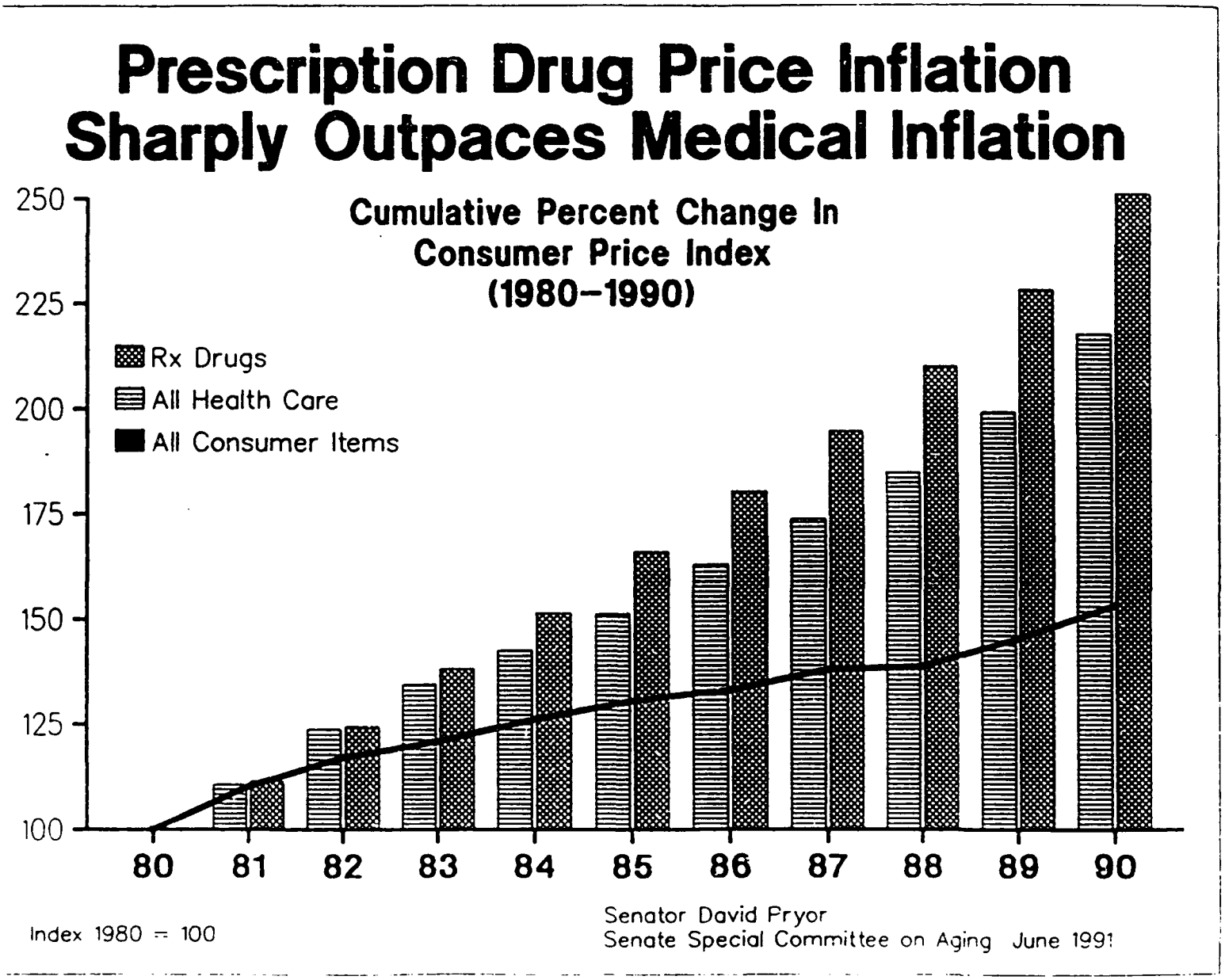


Figure 15. Prescription drug price inflation sharply outpaces medical inflation.
Note. From The Drug Manufacturing Industry: A Prescription for Profits (Staff Report, Serial No. 102-F) (p. 20) by United States Senate Special Committee on Aging, 1991, Washington, DC: Government Printing Office.

APPENDIX

DEFINITION OF VARIABLES

NO.	VARIABLE	TYPE	DEFINITION
1	Number of Prescriptions	Continuous	Average number of prescriptions which a physician writes in one month
2	Total Cost	Continuous	Total cost of all prescriptions which a physician writes in one month
3	Average Cost	Continuous	Average cost of prescriptions which a physician writes in one month
4	Captain	Dichotomous (1 = Yes)	Military rank pay grade O3
5	Major	Dichotomous (1 = Yes)	Military rank pay grade O4
6	Lieutenant Colonel	Dichotomous (1 = Yes)	Military rank pay grade O5
7	Colonel	Dichotomous (1 = Yes)	Military rank pay grade O6
8	Age	Continuous	Age expressed in years
9	Active Federal Service	Continuous	Total of all active duty service time expressed in months
10	Advanced Course	Dichotomous (1 = Yes)	Signifies if an officer completed an officer advanced course
11	Uniformed Services University of the Health Sciences	Dichotomous (1 = Yes)	Signifies graduation from this medical school
12	Foreign graduate	Dichotomous (1 = Yes)	Signifies graduation from a foreign medical school

DEFINITION OF VARIABLES—Continued

NO.	VARIABLE	TYPE	DEFINITION
13	Military Residency	Dichotomous (1 = Yes)	Signifies if an officer completed residency at a military hospital
14	Board Certified	Dichotomous (1 = Yes)	Signifies if an officer is a board certified practitioner
15	Regular Army	Dichotomous (1 = Yes)	Signifies if an officer has a Regular Army commission
16	Direct Appointment	Dichotomous (1 = Yes)	Signifies if an officer received a direct appointment to active duty
17	Born in the United States	Dichotomous (1 = Yes)	Signifies birth in the United States
18	Sex	Dichotomous (1 = Male)	Sex of individual
19	White	Dichotomous (1 = Yes)	Race of individual
20	Black	Dichotomous (1 = Yes)	Race of individual
21	Hispanic	Dichotomous (1 = Yes)	Race of individual
22	Other	Dichotomous (1 = Yes)	Race of individual
23	Number of dependents	Continuous	Total number of claimed dependents
24	Roman Catholic	Dichotomous (1 = Yes)	Religion of individual

DEFINITION OF VARIABLES—Continued

NO.	VARIABLE	TYPE	DEFINITION
25	Protestant	Dichotomous (1 = Yes)	Religion of individual
26	Jewish	Dichotomous (1 = Yes)	Religion of individual
27	Other	Dichotomous (1 = Yes)	Religion of individual
28	Married	Dichotomous (1 = Yes)	Marital status of individual
29	Military Schools	Continuous	Total number of military schools attended by individual
30	PULHES	Dichotomous (1 = All 1s)	Physical profile of an officer expressed numerically from 1 to 5
31	Height	Continuous	Height of individual expressed in inches
32	Weight	Continuous	Weight of individual expressed in pounds
33	Awards	Continuous	Total number of military awards
34	Badges	Continuous	Total number of military skill badges
35	Assignments	Continuous	Total number of assignments that resulted in a permanent change-of-station move, to include Operation Desert Shield/ Storm service
36	Obstetrics/Gynecology	Dichotomous (1 = Yes)	Physician specialty
37	Family Practice	Dichotomous (1 = Yes)	Physician specialty

DEFINITION OF VARIABLES—Continued

NO.	VARIABLE	TYPE	DEFINITION
38	Dermatology	Dichotomous (1 = Yes)	Physician specialty
39	Internal Medicine	Dichotomous (1 = Yes)	Physician specialty
40	General Surgery	Dichotomous (1 = Yes)	Physician specialty
41	Pediatrics	Dichotomous (1 = Yes)	Physician specialty
42	Psychiatry	Dichotomous (1 = Yes)	Physician specialty
43	Neurosurgery	Dichotomous (1 = Yes)	Physician specialty
44	Orthopedics	Dichotomous (1 = Yes)	Physician specialty
45	Ophthalmology	Dichotomous (1 = Yes)	Physician specialty
46	Physical Medicine	Dichotomous (1 = Yes)	Physician specialty
47	General Medicine	Dichotomous (1 = Yes)	Physician specialty
48	Emergency Medicine	Dichotomous (1 = Yes)	Physician specialty

DEFINITION OF VARIABLES—Continued

NO.	VARIABLE	TYPE	DEFINITION
49	Otolaryngology	Dichotomous (1 = Yes)	Physician specialty
50	Anesthesia	Dichotomous (1 = Yes)	Physician specialty
51	Urology	Dichotomous (1 = Yes)	Physician specialty
52	Pathology	Dichotomous (1 = Yes)	Physician specialty
53	Fort Riley	Dichotomous (1 = Yes)	Location of physician
54	Fort McClellan	Dichotomous (1 = Yes)	Location of physician
55	Fort Hood	Dichotomous (1 = Yes)	Location of physician